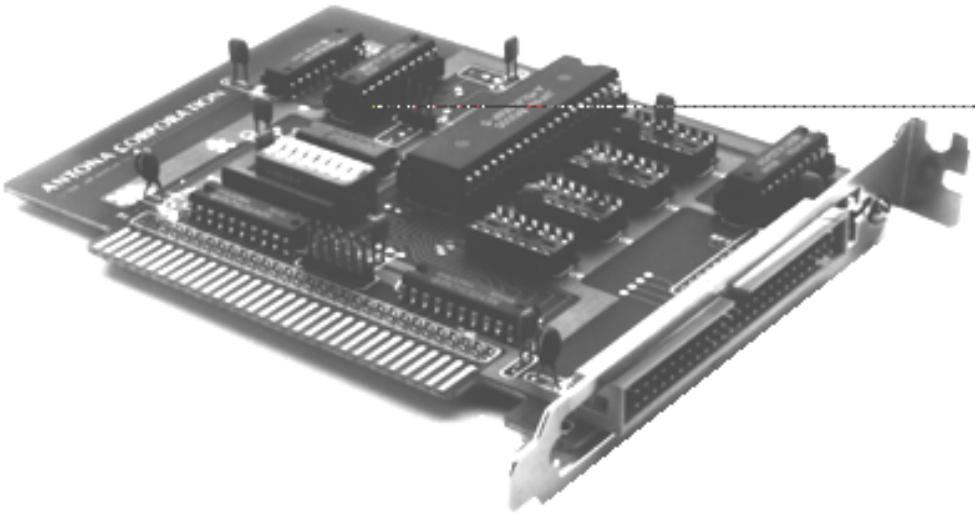
Rev. D
$15.00

ANC - 1055
24 Channel Digital I/O
Pc Compatible Card

Antona

Antona Corporation, Los Angeles, CA



1643 ½ Westwood Blvd., W. Los Angeles, CA 90024 (310)473-8995 FAX (310) 473-7112

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Table of Contents

1.0 OVERVIEW 1

1.1 CARD INITIALIZATION 1
1.2 INTERRUPT OPERATION 2
1.3 I/O PORT FUNCTION 2
1.3.1 I/O PORT ADDRESSING 2

2.0 CARD GENERAL HARDWARE INFORMATION 3

2.1 CARD HARDWARE OPTIONS 4
2.1.1.0 CARD ADDRESS - 8-BIT SWITCH 4
2.1.1.1 PAL TYPE SELECTION (JUMPER 1 AND 3) 4
2.1.1.2 PORT A DIRECTION (JUMPER 2) 4
2.1.1.3 INTERRUPT VECTOR SELECT (JUMPER 4) 5
2.1.1.4 RIBBON CABLE CONNECTIONS (J1) 6
2.1.1.5. USER SELECTED PORT BUFFERS/TERMINATORS 7

3.0 SOFTWARE DESCRIPTION 7

APPENDIX A - SAMPLE CARD PROGRAMS 9

APPENDIX B - OPTO 22 PIN OUTPUTS 12

APPENDIX C - 8255 PERIPHERAL CONTROLLER CHIP 13

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ANC-1055 IBM Pc/XT/AT Compatible Digital I/O Card

1.0 Overview

Providing 3-8 bit buffered TTL I/O channels, the ANC-1055 occupies a short card slot in the IBM Pc, /XT or /AT computer. Programmable interrupt circuitry is provided to monitor 4 of the 24 channels to generate a user selectable, and software enabled, interrupt to the IBM Pc. There are 3 separate modes of operation, all under software control, allowing bidirectional, dedicated or strobed Input/Output operation. Additionally the ANC-1055 card is directly pin connection compatible with the Opto 22, Crydom and Gordos lines of modular relay boards to provide an industrial quality interface for control and monitoring applications. Specifically, the ANC-1055 card is directly compatible with the PB16 and PB24 series units with the appropriate interface cable (available from ANTONA as an ANC-CABL). The designer should be aware that the pin numbers on the ANC-1055 J1 connector and the control module numbers on the PB Series I/O Modules do not match. Refer to the technical manual for the specific manufacturers module for input/output control signal designation.

Programming can be performed in ASSEMBLY LANGUAGE or by using English-like INP/OUT commands in MS-DOS BASIC. The User's Manual included with the card provides both BASIC and ASSEMBLY LANGUAGE source code which the designer may use as a basis for develping his own device drivers.

1.1 Card Initialization

Upon system power-up the card's 8255 control register must be loaded with the desired system configuration. A sample initialization program is included as Appendix A of this manual.

The general procedure for initialization of the card is as follows:

1. Initialization of the peripheral controller 8255 chip.

2. Initialization of the Control Latch to enable interrupt generation and data direction flow of Port A, if used.

3. If interrupts are used, enabling the selected bit on the 8259A interrupt chip's mask register located on the motherboard of the Pc to honor the selected interrupt vector (see IBM Technical Reference).

4. Transfer control to start execution of user stored BASIC (or 8088 ASSEMBLY LANGUAGE program).

1.2 Interrupt Operation

The general procedure for using interrupts is as follows:

1. Enable interrupts un der software control.

2. When interrupt is requested, save all registers.

3. Input status to determine source of interrupt-read 8255 to determine interrupt source, if needed.

4. Do interrupt service routine.

5. Restore all registers, re-enable software interrupts and return to main program.

The ANC-1055 can provide up to 4 interrupt inputs directed to any one of 5 user selected interrupt vector locations. This means that the user can enable under software control 0 to 4 individual interrupt sources, directed to a single interrupt vector location. The user then inputs port C and port A of the 8255 and examines the proper bits to determine the source of the interrupt. The user must set up the IBM Pc's interrupt controller chip (8259) in addition to providing the appropriate interrupt hadling software.

1.3 I/O Port Function

The ANC-1055 has a variety of I/O modes. All of the modes can be directly controlled under MS-DOS BASIC ir 8088 ASSEMBLY LANGUAGE. Appendix C is a detailed specification of the 8255 Peripheral Controller Chip covering the various modes. Basically, the user outputs a single control byte to control port D, which configures port A,B and C to the desired mode.

There are 3 main modes of operation, allowing bidirectional I/O on port A, dedicated I/O on ports A,B and C, with port C being capable of 4 bits each of input or output. The last mode offers strobed Input/Output operation to latch input data and generate an interrupt or status line to the 8088.

1.3.1 I/O Port Addressing

The following table details the address and function performed for I/O port operation.

CARD PORT	**BIT WEIGHT 9 8 7 6 5 4 3 2 1 0**	**HEX VALUE** AS SHIPPED	**COMMENT**
A	X X X X X X X 0 0 0	300H	8-bit I/O port, LS645 buffer
B	X X X X X X X 0 0 1	301H	8-bit I/O port, TTL sockets
C	XX X X X X X 0 1 0	302H	8/(2-4)-bit I/O port, TTL sockets
D	XX X X X X X 0 1 1	303H	Configuration Control Port
E	XX X X X X X 1 0 0	304H	Interrupt Contol./Port A direction control

note that the "X"s are user selected bits set on the 8-bit switch on the ANC-1055 card.

The output/input bits are directed to the 50-pin ribbon connector located at the right side of the ANC-1055 card, a ground and +5v connection are also provided at the connector. See hardware connector section or schematic for pinouts.

The function of the individual bits on Port E are as follows:

Bit Weight	**Function**
0	High level ("1") enables interrupt input on Port C, Bit 3
1	High level ("1") enables interrupt input on Port C, Bit 4
2	High level ("1") enables interrupt input on Port C, Bit 0
3	If jumper 2 enabled, will control direction of data flow to LS645 on Port A - "1" for output, "0" for input.
4	High level ("1") enables interrupt input on Port A, Bit 7
5	- not used -
6	- not used -
7	Master Interrupt Enable Bit, "0" to enable, "1" to disable

This port should be set-up shortly after power-up, depending upon the user applications.

**** *IMPORTANT - INTERRUPT INPUTS ARE DETECTED, DEPENDING ON HOW THE USER INITIALIZED THE 8255, FOR LOW-GOING EDGE OR LOW-LEVEL INPUT. THE PORT A BIT 7 INTERRUPT IS LOW-LEVEL INPUT ONLY.*

2.0 Card General Hardware Information

The ANC-1055 is electrically and mechanically compatible with the IBM Pc/XT/AT. Installation of the card within the mainframe of the Pc should be performed as detailed by any of IBM's Inventory Checklists which explain adding circuit cards to the IBM Pc motherboard. The procedure basically consists of:

1. Remove the power cord from the base unit.

2. Remove the screws on the back of the unit and pull forward the unit cover.

3. Remove the metal plate at any unused card slot location.

4. Install the ANC-1055 Card (set card address before insertion).

5. Replace cover, screws and power cord last. Connect mating 50-pin female ribbon cable connector to ANC-1055 at rear of unit.

2.1 Card Hardware Options

The following sections detail the use and changes of the strap options of the ANC-1055. To properly identify the pin locations, place the card component side up with the card's gold connector pointed towards you. The "common connection" designates where one end of the jumper should always be connected to the desired card action or operation. Some jumpers merely enable functions (like interrupt vector), while others allow selection of hardware modes of operation. Some of the strap options may require a circuit trace on the solder side of the card between pads to be cut with an X-Acto Knife or Dremel Tool.

2.1.1.0 Card Address - 8-Bit Switch

The switch can be set to occupy any address on the Pc from 000H to 3F8H in increments of 8-addresses. When shipped, the card is set to address 300H. This means that Port A is 300H, and all other ports are referenced from 300H

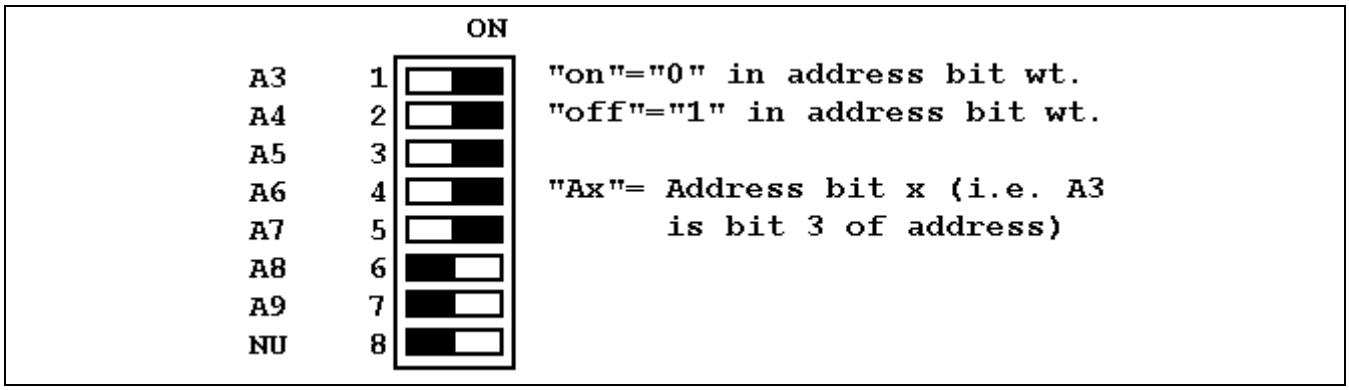

Figure 2.1

2.1.1.1 PAL Type Selection (Jumper 1 and 3)

These 2 jumpers are included to disable input to pins 12 and 19 of the U2 GAL (jumpers included to maintain compatibility with previous versions of the ANC-1055 where a PAL16L8CN was used). These jumpers allow the user to disconnect the external interrupt from port A bit 7 (JP1) and port C bit 0 (JP3). User should not be concerned with disconnecting these jumpers unless a PAL (not GAL) is in the U2 socket.

2.1.1.2 Port A Direction (Jumper 2)

This 3 pin jumper allows the user to select the source of direction control for port A. If the jumper shorts posts "W" and "Y", then bit 3 of the Port E control latch controls direction(as shipped). Port A must be configured for input normally and set to output in response to the state of port C bit 6 level. If "Y" and "Z" jumper posts are shorted, then the state of Port C bit 6 will control direction. Note that if Port C is an input port, then either an external drive signal connected to the port C bit 6 pin, or the Port E bit 3 latch can control the direction of data flow. Lastly, the user can install jumpers in both "V" to "Z" and "W" to

"Y" so that the Port E bit 3 signal can control direction and drive the Port C bit 6 when port C is used in input mode.

2.1.1.3 Interrupt Vector Select (Jumper 4)

There are 5 vectors that can be chosen for the card to jump to when an interrupt is generated. The schematic and the table below show what interrupt is generated.

VECTOR	PIN # (REV. B)	PIN # (REV. A)
IRQ2	**2**	**5**
IRQ3	**3**	**2**
IRQ4	**4**	**1**
IRQ5	**5**	**3**
IRQ7	**7**	**4**

The version B silk-screen artwork for the ANC-1055 has been changed so that the single digit associated with the interrupt pin identifies the IRQ line on the Pc's bus.

2.1.1.4 Ribbon Cable Connections (J1)

The 50-pin I/O ribbon cable connector located on the ANC-1055 provides output connection for all 24 lines. There is a ground line provided between each signal line, and a +5v output line for signal pull-up, if required. The figure below details the port and bit assigned to each pin.

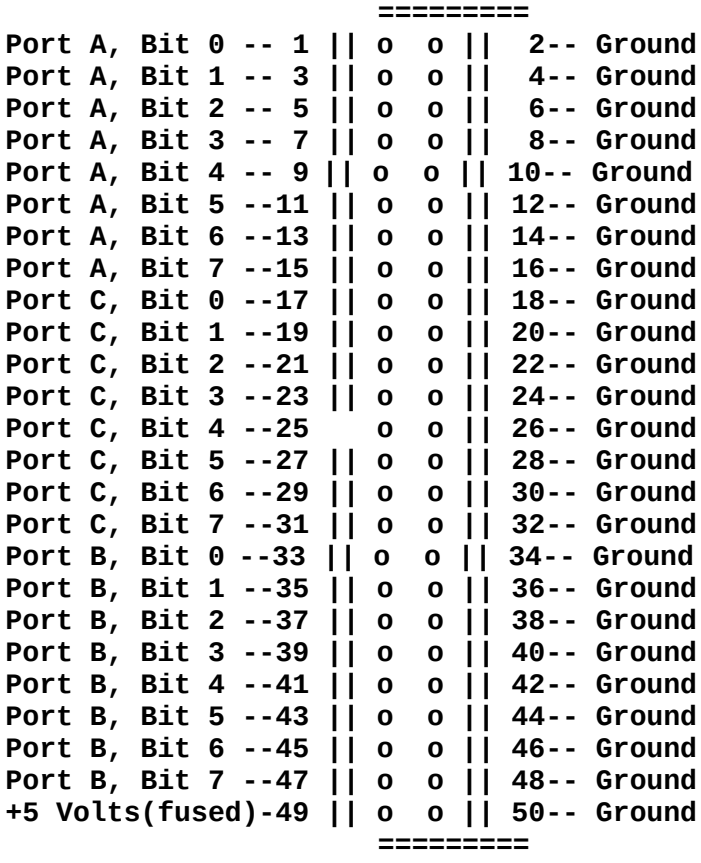
Port A, Bit 0 -- 1 || o o || 2-- Ground
Port A, Bit 1 -- 3 || o o || 4-- Ground
Port A, Bit 2 -- 5 || o o || 6-- Ground
Port A, Bit 3 -- 7 || o o || 8-- Ground
Port A, Bit 4 -- 9 || o o || 10-- Ground
Port A, Bit 5 --11 || o o || 12-- Ground
Port A, Bit 6 --13 || o o || 14-- Ground
Port A, Bit 7 --15 || o o || 16-- Ground
Port C, Bit 0 --17 || o o || 18-- Ground
Port C, Bit 1 --19 || o o || 20-- Ground
Port C, Bit 2 --21 || o o || 22-- Ground
Port C, Bit 3 --23 || o o || 24-- Ground
Port C, Bit 4 --25 o o || 26-- Ground
Port C, Bit 5 --27 || o o || 28-- Ground
Port C, Bit 6 --29 || o o || 30-- Ground
Port C, Bit 7 --31 || o o || 32-- Ground
Port B, Bit 0 --33 || o o || 34-- Ground
Port B, Bit 1 --35 || o o || 36-- Ground
Port B, Bit 2 --37 || o o || 38-- Ground
Port B, Bit 3 --39 || o o || 40-- Ground
Port B, Bit 4 --41 || o o || 42-- Ground
Port B, Bit 5 --43 || o o || 44-- Ground
Port B, Bit 6 --45 || o o || 46-- Ground
Port B, Bit 7 --47 || o o || 48-- Ground
+5 Volts(fused)-49 || o o || 50-- Ground

Figure 2.1
J1 50-pin ribbon cable I/O connector (viewed looking into connector)

2.1.1.5. User Selected Port Buffers/Terminators

There are 4 sockets located near the 50-pin connector which may be populated with a variety of TTL compatible drivers or resister termination networks. When shipped, the card is populated with 74S32 buffers - but note that any 74xx series part may be put into these sockets for output buffering (i.e. 74S125 for tri-state, 74S00 for inverted output, 74S38 for open-collector buffering, etc.). Port A has an on-board LS245/LS645, to provide input or output buffering. The chip is socketed so that the user may replace this part with a 74LS640 through 74LS644 for open collector, tri-state or inverted output/input. If any of the three 8-bit ports requires a passive pull-up or pull down, a resister pack site is provided for each port (RP2 for port A, RP3 for port C and RP4 for port B). The user may select the resister value as appropriate to the application. Pin 1 of each resister pack site is connected to +5 volts, and pin 10 is connected to ground (note RP4 pin 1 is located nearest the F1 fuse and is fused through F1 *See schematic*).

For input operation of ports B and C, the user may use 14-pin component headers a provide a 1K resister pulled-up to +5v either installed in the resister packs or soldered onto the component headers. For long line termination with a 220 ohm resister to +5v and a 330 ohm resister to ground. Note that because port C is programmable for 4-bits input/output, that a buffer may be needed for 1 socket while a terminator header may be needed for the input socket site.

The port bits are associated with the following sockets:

Port	Bits	14-Pin Socket	Comment
B	0-3	U8	PT B LWR
B	4-7	U9	PT B UPR
C	0-3	U6	PT C LWR
C	4-7	U4	PT C UPR

3.0 Software Description

The ANC-1055 may be controlled under MS-DOS BASIC or 80X86 Assembly Language. The most common use is probably with BASIC, but in applications where speed of operation is critical, Assembly Language may be the only choice. Note that a user may write driver software that is "CALLed" from BASIC, or is completely interrupt driven and operates as a background task or serviced when the attached device to the ANC-1055 signals through one of 4 interrupt lines.

Driver software may be divided into 3 basic tasks, initialization, reading and writing to the card. Initialization should be performed as soon after power up as possible as the 8255 controller chip on the ANC-1055 will be configured a 3 input ports. The designer should consider this factor if the ANC-1055 is intended for control application where drive signals could be applied with the card uninitialized. A common practice is to have one output bit assigned as a low enabled "system enable". In this way only after the card has been initialized and the enable bit set low, will the control signals to the peripheral device under control be honored. An alternate method is to use logic such that only when the ANC-1055

outputs a low signal on any of the port lines will the peripheral go into operation - called "negative true logic". In all cases the designer is responsible for handling powerfail or other computer problems. Once the digital input/output card is initialized, the user need only format the 8-bit data to output and write it to the port for the write operation. Reading is performed by inputting from the ports configured for input operation. This process may sound complicated, but really is not. Examine the sample BASIC and Assembly Language software drivers in Appendix A to get a better feel for the whole operation. Note that for AT operation the user should not initialize and then read/write to a port in Assembly Language. This is because at AT speeds the 8255 requires more time to configure itself then the hardware can handle before the next command arrives. Solution - place a 'NOP' instruction between initialization commands and reading/writing to the 8255.

Appendix A - Sample Card Programs

The following BASIC listing provides a sample software driver for card initialization, reading and writing - it is a sample only and is not intended for resale by the purchaser or end-user nor is it supported in any way by the Antona Corporation. It is supplied only as a basis for the purchaser of the ANC-1055 to get an idea of the capabilities and features of the card.

```
10 REM
20 REM    SET ANC-1055 UP FOR 24 OUTPUT BITS,
30 REM    THEN OUTPUT ALL POSSIBLE BITS PATTERNS
40 REM    TO EACH PORT A,B AND C
50 REM    CARD SET TO ADDR 300H (AS SHIPPED)
55 REM
60 A=&H300: B=A+1: C=A+2: D=A+3: E=A+4
70 REM
80 REM    SET PORTS TO OUTPUT, BUFFER ON PORT A TO OUTPUT
90 REM
100 OUT D,&HBC: OUT E,0
110 REM
120 REM   DO BINARY UP COUNT AND OUTPUT TO EACH PORT
130 REM
140 FOR X= 0 TO 255
150 OUT A,X: OUT B,X: OUT C,X
160 NEXT X
170 GOTO 140
180 END
------------------------------------------------------------
1000 REM
1010 REM  A N T O N A  CORPORATION              REV.1.1
1020 REM
1030 REM  SAMPLE ANC-1055 INITIALIZATION,READ AND WRITE
1040 REM  SUBROUTINES
1050 REM  THE FOLLOWING MS-DOS BASIC PROGRAM LISTING
1060 REM  PROVIDES 3 SIMPLE PROGRAMS WHICH READ IN AND
1070 REM  WRITE OUT THE SAME BUFFER OF 1024 BYTES,  THESE
1080 REM  ROUTINES MAY BE USED AS SUBROUTINES FROM A MAIN
1090 REM  PROGRAM WHICH INTERFACES WITH THE ANC-1055 CARD.
1100 REM
2000 DIM BUF%(1024)
2010 REM
2020 REM  INITIALIZE ANC-1055 CARD
2030 REM
2040 A=&H300: B=A+1: C=A+2: D=A+3: E=A+4
2050 OUT D,&HBC: OUT E,0
2060 DUM=INP(A)
2070 RETURN
2080 REM
2090 REM  READ IN A BUFFER OF 1024 CHARACTERS
2100 REM
2110 FOR X=0 TO 1023 2120 IF INP(C) AND &H20 THEN GOTO 2130 ELSE 2120
2130 BUF%(X)=INP(A)
```

```
2140 NEXT X
2150 RETURN
2160 REM
2170 REM  WRITE OUT A BUFFER OF 1024 CHARACTERS
2180 REM
2190 FOR X=0 TO 1023
2200 OUT B,(BUF%(X) AND &HFF)
2210 IF INP(C) AND &H4 THEN GOTO 2210
2220 NEXT X
2230 RETURN
------------------------------------------------------------
```

Assembly Language Programs

The ANC-1055 may be driven directly by ASSEMBLY LANGUAGE with an increase of operational speed up to 400:1 compared to a similar BASIC routine (as above). The following programs detail how the ANC-1055 may be used to read/write to a data buffer 1024 characters long. The user will note that other functions would need to be performed in order for these routines to be useful (i.e. loading buffer, setting up whatever peripheral is being communicated with, etc.).

```
;
;EQUATES (BASED ON ANC-1055 CARD BASE ADDR OF 300H,AS SHIPPED)
;
PORTA     EQU       300H      ;8 BIT PORT A (CHANGE AS APPROP)
PORTB     EQU       PORTA+1   ;8 BIT PORT B
PORTC     EQU       PORTB+1   ;8 BIT PORT C
CNTL      EQU       PORTC+1   ;CONFIGURATION REG. OF 8255
PORTE     EQU       CNTL+1    ;INTR. ENABLE/ PORT A DIRC.
;
; DATA BUFFER AREA
;
BUFFER    SEGMENT AT xxH ;BUFFER LOCATION DEFINED BY USER
          DB   1024      ;RESERVE 1024 LOCATIONS

;
; INITIALIZE ANC-1055 CARD
;
; WILL MAKE USE OF THE MODE 1 'HANDSHAKING' OPERATION OF THE 8255
; FOR INPUT.
;
INIT      MOV  DX,CNTL   ;SET UP CONTROL REG. ON 8255
          MOV  AL,0BCH   ;SETS UP PORT A FOR INPUT, B FOR OUTPUT
          OUT  DX,AL     ;(SEE APPENDIX C, P.10-180)

          MOV  DX,PORTE  ;SET LATCH FOR PORT A INPUT OPERATION
          MOV  AL,0      ;AND DISABLE ALL INTERRUPT INPUT PINS
          OUT  DX,AL     ;(SEE P.4 OF MANUAL - PORT E)
          MOV  DX,PORTA  ;DO A DUMMY READ TO FLUSH CHARACTER ON
          IN   AL,DX     ;POWER-UP
```

```
          RET
;
; READ IN A BUFFER OF 1024 CHARACTERS
;
RD1055    PUSH AX
          PUSH BX
          PUSH CX         ;SAVE ALL REGISTERS
          PUSH DX
          MOV  BX,BUFFER ;BEGINNING OF WHERE DATA IS STORED
          MOV  CX,1024   ;# OF CHARACTERS TO READ-IN

LOP1      MOV  DX,PORTC  ;USE TO SIGNAL WHEN DATA IS PRESENT
          IN   AL,DX     ;READ IN STATUS BYTE
          AND  AL,20H    ;JUST LOOK AT BIT
          JZ   LOP1      ;NEXT CHARACTER HERE YET?

          MOV  DX,PORTA  ;SET UP TO READ PORT A
          IN   AL,DX     ;GET BYTE
          MOV  [BX],AL   ;STORE IN COMPUTER'S BUFFER

          INC  BX        ;INCREMENT BUFFER ADDRESS
          DEC  CX        ;DECREMENT LOOP COUNTER
          JNZ  LOP1      ;GET NEXT BYTE, OR EXIT
          JMP  EXIT      ;ALL DONE
;
; WRITE OUT A BUFFER OF 1024 CHARACTERS
;
WR1055    PUSH AX
          PUSH BX
          PUSH CX         ;SAVE ALL REGISTERS
          PUSH DX
          MOV  BX,BUFFER ;BEGINNING OF WHERE DATA IS STORED
          MOV  CX,1024   ;# OF CHARACTERS TO READ-IN

LOP2      MOV  DX,PORTB  ;SET UP TO WRITE PORT B
          MOV  AL,[BX]   ;GET BYTE FROM COMPUTER'S BUFFER
          OUT  DX,AL     ;WRITE BYTE TO PORT B

LOP3      MOV  DX,PORTC  ;USE TO SIGNAL WHEN DATA IS PRESENT
          IN   AL,DX     ;READ IN STATUS BYTE
          AND  AL,04H    ;JUST LOOK AT BIT
          JNZ  LOP3      ;DATA ACCEPTED YET?
          INC  BX        ;INCREMENT BUFFER ADDRESS
          DEC  CX        ;DECREMENT LOOP COUNTER
          JNZ  LOP2      ;GET NEXT BYTE, OR EXIT

EXIT      POP  DX        ;RESTORE REGISTERS
          POP  CX
          POP  BX
          POP  AX
          RET            ;ALL DONE - EXIT TO CALLER
```

Appendix B - Opto 22 Pin Outputs

ANC-1055 J1	OPTO-22 PB-24	OPTO-22 PB-16	OPTO-22 PB-8	RELAY POSITIONS
1	1			23
3	3			22
5	5			21
7	7			20
9	9			19
11	11			18
13	13			17
15	15			16
17	17	17		15
19	19	19		14
21	21	21		13
23	23	23		12
25	25	25		11
27	27	27		10
29	29	29		9
31	31	31		8
33	33	33	33	7
35	35	35	35	6
37	37	37	37	5
39	39	39	39	4
41	41	41	41	3
43	43	43	43	2
45	45	45	45	1
47	47	47	47	0
49	49	49	49	+5VDC

NOTE: 1. PINS 2-50 ARE GROUND

Appendix C - 8255 Peripheral Controller Chip

The following pages provide an overview of the 8255 chip operation. Note that the operation options, limitations, register definitions and input/output modes are all covered. The IBM TECHNICAL REFERENCE (#6025005) is also an excellent source of information on the 8259 Controller Chip. Of particular use are the pages showing I/O configurations when the appropriate initialization word is output to the 8255.

NOTE: This Appendix is included with purchase of product.